The Phase III Expansion of the White Street Sanitary Landfill

Greensboro, North Carolina

Construction Permit Application

November 1995

Prepared by:

HDR Engineering, Inc.
of North Carolina
128 S. Tryon Street, Suite 1400
Charlotte, NC 28202-5001

HDR

HDR Engineering, Inc.
of North Carolina

November 7, 1996

HDR

Mr. William D. Sessoms, P.E.
Division of Waste Management
N.C. Dept. of Environment, Health,
and Natural Resources
P. O. Box 27687
Raleigh, North Carolina 27611-7687

Re: Greensboro White Street Landfill
Phase III Construction Permit Application
Response to Review Comments dated October 9, 1996
HDR Project No.: 06770-021-018

Dear Mr. Sessoms:

This letter is provided in response to the review comments from your office dated October 9, 1996, regarding your review of the Design Hydrogeologic Report for the Phase III Expansion of the White Street Landfill. Your comments have been retyped in ***bold italics***, with the responses following.

Material attached with this response letter includes:

- Revised Construction Plan Report (entire report). Changes are depicted by underlines and overstrikes.

- Revised Design Hydrogeologic Report (entire report). Changes are depicted by underlines and overstrikes.

- Revised Appendix A cover sheet and core logs to be added to Appendix A; revised Appendix B (replace entire contents); revised cover sheet for Appendix C (slug test data); and new Appendix D (entire).

- Revised Water Quality Monitoring Plan (entire plan). Changes are depicted by underlines and overstrikes.

- Revised Calculations (partial). Refer to references in this letter and new Calculations Table of Contents for insertion and/or removal of Calculation.

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- Revised Technical Specifications (partial). New Specification Sections include 09905, 13250, and 13251. Other Specification Sections included should replace original submittal. Sections include 02240, 02276, 02515, 02775, 02900, 02999, 15066, and 15900. Edits to these sections are incorporated without underlines and strikeouts. Refer to specific responses in this letter for exact location of changes.

- Revised Construction Permit Application Plans (entire plan set). For clarity, the entire plan set has been included.

LETTER TO ELIZABETH TREADWAY FROM WILLIAM D. SESSOMS, DATED OCTOBER 9, 1996

.1620(d)(1)(A) The Engineering Plan, Section 3.1.2 refers to possible revisions to the base grade elevations. The base grade elevations must be finalized prior to issuance of the permit. Additional comments relating to the base grade elevations are contained in the hydrogeological review memorandum.

The base grade elevations have been revised to reflect the required separation from the estimated long-term seasonal high water table. Estimates are based on more recent ground-water readings taken at the site. The new base grades also reflect consideration of the comments from Mr. Lutfy addressed later in this text.

.1620(d)(2)(A) & (B) The calculations in the report have been reviewed. However, a brief discussion of the analytical methods, conditions evaluated, and assumptions needs to be included in the engineering report.

The Construction Plan Report has been revised to contain a brief description for the attached calculations.

.1620(d)(4) Please refer to the attached hydrogeological review memorandum.

Responses to the comments included in the hydrogeological review memorandum are included later in this text.

.1620(e)(1) Revise the existing topography to reflect actual existing conditions at the site to include all grading and the berm(s) that exist within the facility.

All of the drawings have been revised to reflect the current site topography mapped by aerial photography dated May 18, 1996.

.1620(e)(2) The Section recommends adding a requirement that survey verification of the sub-grade be provided to the CQA consultant prior to placement of clay liner. In a similar fashion, survey verification of the clay liner should be provided to the CQA consultant prior to placement

of the HDPE liner. This is indirectly implied in portions of the Technical Specifications, however, a direct requirement may avoid potential problems.

Section 3.03 of the Soil Liner Specification (Section 02276) has been clarified to require verification of clay liner thickness. The Geomembrane Liner Section (02775), paragraph 3.01,A.3., requires that soil liner is approved prior to placement of HDPE liner. Section 9.7 of the CQA plan requires that the CQA consultant and contractor review thickness measurements of the soil liner prior to placement of the geomembrane liner.

.1624(b)(5) & (6) Indicate on plans the location of the permanent (or proposed permanent) benchmark locations.

Two proposed permanent bench marks have been indicated in the Phase III area. Refer to Drawing C-2.

.1624(b)(7) Provide information demonstrating that post settlement base grade slopes will maintain a minimum 2% grade. If information or assumptions were presented in the application that establish this demonstration, please direct our attention to them.

Calculations have been included conservatively estimating a differential settlement of approximately 0.08% between the middle and edge of the landfill. The majority of the landfill base grades exceed 2%, and some areas of 2% grade will be increased with loading. With the minimal differential settlement, we consider this criteria satisfied.

.1624(b)(8)(A)(i) What is the testing frequency specified for hydraulic conductivity testing of the clay liner?

Hydraulic conductivity (ASTM D-5084) will be tested at a minimum frequency of one test per acre per lift. Refer to Specification Section 02276, 3.03 B.5.

.1624(b)(9)(B)(iii) Provide information demonstrating stability of the anchor trench design. If information or assumptions were presented in the application that establish this demonstration, please direct our attention to them.

Anchor trench design requirements have been included in the calculations.

.1624(b)(9)(B)(iv) Provide information demonstrating that the geomembrane will be adequately protected from the granular leachate drainage material. If information or assumptions were presented in the application that establish this demonstration, please direct our attention to them.

Evaluation of puncturability was performed by the Southwest Research Institute (Daren L. Laine and colleagues) for the EPA in March 1988, in a report entitled "Loading Point Puncturability Analysis of Geosynthetic Liner Materials." The report evaluates various particle sizes (3/8" to 1") placed under a geosynthetic with hydrostatic load applied above. The evaluation verifies that, under the

conditions evaluated, 60 mil HDPE is sound without geotextile underlayment when the particle size is 3/8″ or less. The specifications allow a maximum particle size of 3/8″. While the loading pressure in the evaluation was less than the anticipated waste loading at Phase III, the smaller specified particle gradation, coupled with the buffering effect of smaller particles adjacent to larger particles, should ensure stability.

.1624(b)(9)(C)(ii) This requirement was not found in the CQA plan or the Technical Specifications. If this requirement is addressed in the application, please direct our attention to the location.

Test seaming requirements are included in Section 02775, 1.03, A.1.b.5).

.1624(b)(9)(C)(iii) What is the maximum length of seam that will be air pressure tested?

There is no maximum length of seam specified for air pressure testing. Typically, this distance would be equal to or less than the roll length. Depending on the site specific panel layout, the CQA consultant will discuss the specific air testing criteria.

.1624(b)(10)(A)(i) Revise the 4-inch diameter leachate pipes to 6-inches (plan sheet C-3).

All leachate pipes now proposed are 6 inches or larger. See Sheet C-3.

.1624(b)(12)(A)(i) This requirement was not found in the CQA plan or the Technical Specifications. If this requirement is addressed in the application, please direct our attention to the location.

The requirement of no more than 5% by weight passing the number 200 sieve has been included in Section 02240, 3.02.

.1680(c)(1), (A), & (B) This requirement was not found in the CQA plan or the Technical Specification. If this requirement is addressed in the application, please direct our attention to the location.

Specification Sections 9905, 13250, and 13251 have been added to address paint systems and both bolted and welded steel tank fabrication.

.1680(c)(2)(B) The secondary containment system must be constructed of an impermeable material such as concrete or concrete walls in combination with an HDPE floor system.

The secondary containment system will be lined. The exact nature of the lining system will be determined based partly on relative costs of competing systems during the bidding process. Alternatives that are currently being considered include a concrete-lined bermed area and large steel tank with concrete floor around the primary tank.

.1680(c)(3) Provide information demonstrating compliance with this requirement.

The secondary containment will be valved (normally closed) to insure proper containment. Notes have been added to Drawings C-3.

MEMO TO BILL SESSOMS FROM BOBBY LUTFY, DATED SEPTEMBER 3, 1996

DESIGN HYDROGEOLOGIC REPORT

Section 2.2: The estimates of the long-term seasonal-high-water table elevations are not adequate.

- ***While the 3/11/95 ground-water elevations appear to be the most reasonable single set of water table measurements representative of seasonal high conditions for the season of record (12/94 through 10/95), they are not adequate to characterize the long-term seasonal high conditions. There are recorded readings in Table 2-2 at some piezometer locations of up to over five feet above the 3/11/95 levels.***
- ***The estimation of long-term water table elevations (Table 2-3) is based on only four readings spread over a two and a half year period. There is no discussion of precipitation levels prior to the readings or longer term readings from other wells in the area. As referenced in Table 2-3, there are recorded readings of up to 2.68 feet above the March 1995 readings. Most of the pre-existing monitoring wells are located at lower elevations, nearer to the discharge streams, and are therefore likely to have a smaller range of water table elevation variability than the piezometers located at higher topographic elevations.***
- ***Padding the 3/11/95 elevations one foot hardly seems adequate to provide a reasonable estimate of the long-term seasonal high water table elevations, considering there are historic readings of the piezometers over five feet higher and historic readings of the monitoring wells (at lower elevations) almost three feet higher. A more accurate estimate of long-term seasonal high water table elevations must be established for each individual piezometer.***

  Since the previous submittal of the Phase III Expansion Construction Permit Application in November 1995, additional ground-water elevation data from Phase III area piezometers have been collected through August of 1996. These additional data have been tabulated and are summarized in Table 2-2. Based on the evaluation of these new data, a new estimate for the long-term seasonal high ground-water table has been developed (Drawing D-2). Section 2.2.2 of the Design Hydrogeologic Report has been modified to include a discussion on how the new long-term seasonal high was developed.

Section 2.4.2: The discussion of Vertical Gradients needs some revision.

- ***The locations of some of the piezometers do not support the statement made in the second sentence of the second paragraph on page 20.***

  The statement made in the second sentence of the second paragraph on page 20 has been amended to more accurately reflect the location of the piezometers.

- ***According to the data presented in Table 2-2, the vertical gradient at the B-22/22d piezometer nest is upward, rather than downward as shown on page 20.***

  The long-term vertical gradient data (summarized in Section 2.4.2) indicates that the vertical component of ground-water flow at piezometer nest B-22/22D has been consistently measured as slightly upward in direction. However, several monitoring events reported a gradient which is essentially horizontal in nature. For some unknown reason, the upward component of flow suggested by this piezometer pair appears to be anomalous based on the fact that all other on-site pairs have consistently reported a downward component of flow throughout their data sets.

- ***Further evaluation of vertical gradients based upon data from other dates is needed. For example, the vertical gradient at the B-9/9d nest seems to shift over time.***

  Vertical gradients were evaluated from the period beginning in January of 1995 through August of 1996 at each of the six nested piezometer pairs. This evaluation is summarized in Section 2.4.2. All of the piezometer pairs consistently reported a downward gradient with the exception of B-22/22D. Piezometer pair B-1/1D showed the greatest fluctuation in magnitude through time (but always downward). Piezometer pair B-9/9D remained fairly consistent in the magnitude of the gradient with only periodic shifts from a slightly downward gradient to an essentially horizontal gradient.

Section 5: Rock Core Descriptions.

- ***In the list of rock cores in the second paragraph, the reference to boring B-2d is incorrect.***

  The list of rock cores presented in the second paragraph of this section has been amended to include B-1d. In addition, a correction was also made to B-17, changing the reference to B-17d. Likewise, a reference to MW-11 was also added.

- ***The boring logs do not report recovery values, RQD values, or descriptions of the core runs. This information needs to be provided.***

  The core description logs for each of the referenced wells (inadvertently left out of the original submittal) have been added to Appendix A (Boring/Core Logs and Piezometer/Monitoring Well Construction Sheets).

Section 11: Vertical Separation Criteria.

- ***As discussed above, additional evaluation of the long term seasonal high water table will be necessary. The vertical separation criteria will have to be altered based upon this additional evaluation.***

Section 2.2.2 has been amended to reflect the changes in the estimated long-term seasonal high water table discussion. Vertical separation criteria shown in Table 11-1 have been altered based upon this additional evaluation.

- ***As discussed repeatedly in previous correspondence, the proposed subgrade does not maintain the four foot vertical separation requirement in the vicinity of piezometers B-19 and B-28. The Solid Waste Management Rules and policy require the subgrade to maintain a minimum of four feet of vertical separation from the bedrock as defined in the hydrogeologic subsurface investigation.***

  As shown in Drawing C-2 and which is summarized in Table 11-1 of the report, a minimum of 4 feet is maintained between the bedrock and the base of the liner system at all boring/ piezometer locations.

- ***The notes below Table 11-1 reference Figures 3-3 and 3-7. These references appear to be incorrect.***

  The notes below Table 11-1 have been amended to reflect the proper reference.

- ***The Subgrade Plan (Drawing C-2) needs to show the exact location of all of the piezometers in order to facilitate interpretation of the vertical separation criteria.***

  The proposed subgrade has been added to Drawing D-6, which also shows all existing soil borings, piezometers, and monitoring wells in and near the Phase III area.

Appendix: Boring Logs.

- ***A number of the soil descriptions and/or soil classifications are not consistent with the laboratory soil testing results, as found in Appendix B.***

  The soil descriptions/classifications found on the laboratory soil testing results included in Appendix B have been amended to reflect the proper soil classifications(s). A number of the classifications were found to be in error based on the grain-size distribution data curves developed by the laboratory.

- ***There are virtually no rock descriptions, recovery values, or RQD values reported for the rock cores.***

  Rock descriptions, recovery values, and RQD values for all cored locations (which were erroneously not included in the original submittal) are included on the core description logs contained in Appendix A.

Appendix B: Geotechnical Analyses.

- ***There are a number of errors and/or discrepancies between the summary table of Soil Boring Depth And SPT Resistance Data and the information reported in the Boring Logs. No information is reported in the summary table for borings B-36, OW-1, OW- 2, or OW-3.***

  Summary table of soil boring depth and SPT resistance data found in Appendix B has been amended to match the information reported on the boring logs in Appendix A. Information on B-36, OW-1, OW-2, and OW-3 has been added.

- ***The depths of the soil samples are not identified on the Grain Size Distribution sheets. Many of the soil descriptions and/or classifications differ from those indicated in the Boring Logs.***

  The depths of the soil samples have been added to the grain size distribution sheets in Appendix B. The descriptions/classifications have been amended to reflect the boring logs (see response above).

Appendix C: Piezometer / Monitoring Well Construction Sheets.

- ***There are no Piezometer or Well Construction Sheets included in Appendix C.***

  The piezometer and monitoring well construction sheets for all piezometers and monitoring wells within and around the Phase III area are now included with the boring logs in Appendix A.

- ***In the summary table provided for Observation Well Construction Details, the Riser Stick-up information is missing for a number of the piezometers.***

  Table 2-1 has been amended to include riser stick-up information for all Phase III piezometers.

- ***There are a number of errors and/or discrepancies between the summary table and the information provided in the Boring Logs.***

  Table 2-1 has been amended to reflect the information provided in the boring logs contained in Appendix A.

WATER QUALITY MONITORING PLAN

Background Well:

- ***A complex geologic setting is described with two major geologic types and yet only one background well is proposed. At a minimum there should be one background well in the Gneiss materials and one in the Granite - materials.***

The Plan has been amended to reflect two background monitoring wells. One well is proposed for installation in the gneissic material (MW-15) and one in the granitic material (MW-16).

- ***Generally it would be better to locate a background well further than 90 feet from the waste boundary, as proposed.***

Background monitoring well MW-15 (Gneiss) has been proposed at approximately 225 feet southwest of the waste boundary. Background monitoring well MW-16 (Granite) has been proposed at approximately 275 feet southeast of the waste boundary.

- ***Generally fifteen-foot well screens are used for monitoring wells screened across the water table in order to allow for seasonal fluctuations in the water table.***

All proposed shallow monitoring wells will be constructed with 15-foot well screens, and the deep monitoring well will be constructed with a 10-foot well screen.

Downgradient (Detection) Wells:

- ***Downgradient monitoring should be located between 100 and 150 feet from the waste boundary. The proposed locations for wells MW-18, MW-19, and MW-20 are too far from the waste boundary.***

All proposed downgradient monitoring wells have been placed approximately 125 feet downgradient of the waste boundary.

- ***Drainage features are sometimes areas of geologic weakness and being more highly fractured are possible preferential groundwater flow pathways. The downgradient wells should therefore be located in these drainage features.***

- ***Based upon the preceding two points, proper location of the monitoring wells may make it necessary to relocate and/or redesign some of the sedimentation control basins.***

- ***Should additional wells be considered . . .***
  - ***at the head of the drainage basin on the west side of the landfill cell, about 500 ft. south of MW-21, or***
  - ***in the weathered Diorite near piezometer B-34 that is two orders of magnitude more conductive than the surrounding material?***

Additional detection monitoring wells have been proposed as follows: installation of MW-24 approximately 500 feet south of proposed well MW-23 at the head of the western drainage basin; installation of MW-18 and MW-18D in the weathered diorite near existing piezometer

B-34. Other amendments included altering the position of downgradient wells MW-19 through MW-22 to be placed at or near the local drainage features.

DRAWINGS

- ***A revised Base Grade drawing (C-2) will need to be prepared that meets the vertical separation requirements. The revised Drawing C-2 should also show the piezometer locations.***

  Revised base grade drawings (C-2 and D-6) have been included which meet the vertical separation requirements. The locations of all piezometers and monitoring wells are shown on Drawing D-6. Vertical separations are summarized on Table 11-1.

- ***Drawing D-1: The TOC Elevations are inconsistent with those in the Boring Logs for piezometers B-5, B-6, OW-1, OW-2, and OW-3. The Ground Elevation for piezometer B-11 is not consistent with the Boring Log. The elevations or piezometer designations appear to be reversed for the B-22/B-22D nest.***

  The TOC elevations shown on Drawing D-1 have been verified and amended to reflect the elevations shown on the boring logs in Appendix A.

- ***Drawing D-2 Groundwater Contour Map: Why was water table data not logged for saprolite piezometers B-2 and B-25? Some of the ground-water contours do not appear to be drawn proportional to the water table readings. For example the contours are drawn such that the 740 contour line is closer to B-4 than the 745 contour line, although the water table elevation for B-4 is 744.76.***

  Boring B-2 had been abandoned. The water level from boring B-25 is incorporated in the completely revised estimated long-term seasonal high water table map which has been prepared and is included as Drawing D-2. Contours on this map are drawn proportional to the values shown at each data point.

- ***While an accurate Drawing D-2 based upon the March 11, 1995, water table data will fulfill the requirement of rule .1623(a)(9), a separate ground-water contour map based upon the estimated long-term seasonal high water table elevations is needed to fulfill .1623(b)(2)(E).***

  Revised Drawing D-2, based upon the estimated long-term seasonal high water table, fulfills the requirements of both rules .1623(a)(9) and .1623(b)(2)(E), as the shape of the water table shown on this map is consistent with the occurrence and direction of groundwater flow in the uppermost aquifer.

- ***Hydrostratigraphic Geologic Cross-sections (D-5A & D-5B): The cross-sections do not characterize the vertical ground-water flow regime, as required by .1623(b)(2)(G). No vertical equipotential lines or flow lines are shown. Also, there are discrepancies between the illustrated information and the information in the Boring Logs. Verification is needed to ensure accurate information is shown for ground surface elevations, water table elevations, boring depths, auger refusal depths, etc.***

  Hydrostratigraphic Geologic Cross-Sections (D-5A & D-5B) have been amended to reflect the vertical ground-water flow regime in accordance with .1623(b)(2)(G). All information shown on the sections has been verified and amendments have been made (as needed).

- ***Drawing D-6, Proposed Monitoring Well Locations: Refer to previous comments on the monitoring system.***

Drawing D-6 showing the proposed monitoring well locations has been amended to reflect the changes made to the Water Quality Monitoring Plan.

Respectfully submitted,

HDR Engineering, Inc. of North Carolina

Joseph C. Readling, P.E.
Project Manager

Curtis M. Welty, P.G.
Senior Geologist

JCR/CMW/nct

THE PHASE III EXPANSION OF THE WHITE STREET SANITARY LANDFILL GREENSBORO, NORTH CAROLINA

CONSTRUCTION PERMIT APPLICATION

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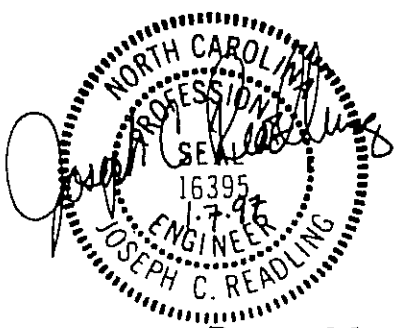

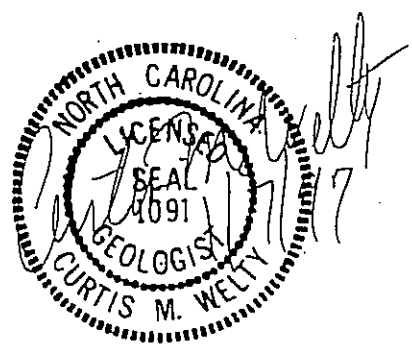

Prepared for:

The City of Greensboro,
North Carolina

Prepared by:

HDR Engineering, Inc. of
North Carolina
Charlotte, NC

Final Report

January 7, 1997

CITY OF GREENSBORO

NORTH CAROLINA

P.O. BOX 3136
GREENSBORO, NC 27402-3136

January 8, 1997

Mr. Williams D. Sessoms, P.E.
Division of Waste Management
N.C. Dept. of Environmental, Health,
and Natural Resources
P.O. Box 27687

Re: Greensboro White Street Landfill
Phase III Construction Permit Application
Final Submittal
HDR Project No. 067700-021-018

Dear Mr. Sessoms:

Enclosed please find five(5) copies of the Final Phase III Construction Permit Application. This application has been revised to address comments included in your letter of December 3, 1996, with attached memorandum from Mr. Bobby Lutfy. The appropriate drawings have been changed and are resubmitted in their entirety. All text changes which were previously denoted by underlines and overstrikes have been removed.

Please contact us if you have any questions or concerns.

Respectfully submitted,

City of Greensboro

Jeryl W. Covington /for

Elizabeth Treadway
Director of Environmental Services

ET/

Enclosures

State of North Carolina
Department of Environment,
Health and Natural Resources
Division of Waste Management

James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary
William L. Meyer, Director

DEHNR

December 3, 1996

MEMORANDUM

TO: Bill Sessoms

FROM: Bobby Lutfy BL

RE: Hydrogeologic Review Of The City Of Greensboro Phase III Expansion Construction Permit Application Revisions

The hydrogeologic review of the proposed Phase III expansion to the Greensboro White Street Landfill Construction Permit Application has been done. There are still a few issues that need further evaluation and revision before the hydrogeologic permit review can be continued. Please have the City of Greensboro and their consultants respond to the following items:

DESIGN HYDROGEOLOGIC REPORT:

Section 2.2 The estimates of the long-term seasonal high water table elevations now appear to be adequate.

Section 2.4.2 The discussion of Vertical Gradients needs some revision.

- According to some previous discussion, the water table data presented for the B-22/22d piezometer nest was thought possibly to be reversed. Has it now been determined that this is not the case and the vertical gradient is indeed upward rather than downward? If there is an upward gradient at this location, could it be due to confining or semi-confining conditions in the deeper bedrock well?
- It appears that the vertical gradients in the table on page 20 have been calculated incorrectly (except for B-1/1D).

Appendix A Boring Logs

- A number of the soil descriptions and/or soil classifications are not consistent with the laboratory soil testing results, as found in Appendix B. I was unable to discern any changes in the revisions that correct these inconsistencies.

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Appendix B Geotechnical Analyses

- There are a still some errors and/or discrepancies between the summary table of Soil Boring Depth And SPT Resistance Data and the information reported in the Boring Logs. The SPT values are still displaced for Borings B-1 and B-1d. B-11 and B-20 SPT values need revision for the 15.0-16.5 depths. And the SPT values for OW-1 in the last two columns are incorrect.
- Many of the soil descriptions and/or soil classifications differ from those indicated in the Boring Logs.

WATER QUALITY MONITORING PLAN:

Background Well:

- Based upon the Geologic Map (Figure No. D-4), both of the proposed background wells shown on Figure No. D-6 are located in gneissic materials. The location of MW-15 appears to be excellent. (However the indistinct horizontal and vertical extent of the granitic intrusion in the vicinity of SB-58 could interfere with a representative gneissic environment monitoring well in this area.) Based upon the Geologic Map, it may be necessary to locate MW-16 in the granitic environment found in the vicinity of the OW piezometers.

Downgradient (Detection) Wells:

- The Water Table Map (Figure No. D-2), the Bedrock Surface Map (Figure No. D-3), and the Base Grade Map (Figure No. C-2) all indicate that the most critical monitoring location is slightly downgradient of Boring B-30. The monitoring well nest should be at this critical monitoring location.
- It would still be good to have one monitoring well located in the weathered Diorite near piezometer B-34.
- With monitoring wells in the vicinity of Boring B-30, consideration may be given to locating MW-20 a little further to the West.

If representatives of the City of Greensboro or HDR Engineering have any questions regarding this memo, they may contact me at (919) 733-0692, extension 258. It would probably be helpful especially in order to clarify the apparent inconsistencies between the soil descriptions in the Boring Logs and those reported in the laboratory soil testing sheets.

November 7, 1996

HDR

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Two proposed permanent bench marks have been indicated in the Phase III area. Refer to Drawing C-2.

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Calculations have been included conservatively estimating a differential settlement of approximately 0.08% between the middle and edge of the landfill. The majority of the landfill base grades exceed 2%, and some areas of 2% grade will be increased with loading. With the minimal differential settlement, we consider this criteria satisfied.

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Hydraulic conductivity (ASTM D-5084) will be tested at a minimum frequency of one test per acre per lift. Refer to Specification Section 02276, 3.03 B.5.

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Anchor trench design requirements have been included in the calculations.

.1624(b)(9)(B)(iv) Provide information demonstrating that the geomembrane will be adequately protected from the granular leachate drainage material. If information or assumptions were presented in the application that establish this demonstration, please direct our attention to them.

Evaluation of puncturability was performed by the Southwest Research Institute (Daren L. Laine and colleagues) for the EPA in March 1988, in a report entitled "Loading Point Puncturability Analysis of Geosynthetic Liner Materials." The report evaluates various particle sizes (3/8" to 1") placed under a geosynthetic with hydrostatic load applied above. The evaluation verifies that, under the

.1680(c)(3) Provide information demonstrating compliance with this requirement.

The secondary containment will be valved (normally closed) to insure proper containment. Notes have been added to Drawings C-3.

MEMO TO BILL SESSOMS FROM BOBBY LUTFY, DATED SEPTEMBER 3, 1996

DESIGN HYDROGEOLOGIC REPORT

Section 2.2: The estimates of the long-term seasonal-high-water table elevations are not adequate.

- ***While the 3/11/95 ground-water elevations appear to be the most reasonable single set of water table measurements representative of seasonal high conditions for the season of record (12/94 through 10/95), they are not adequate to characterize the long-term seasonal high conditions. There are recorded readings in Table 2-2 at some piezometer locations of up to over five feet above the 3/11/95 levels.***
- ***The estimation of long-term water table elevations (Table 2-3) is based on only four readings spread over a two and a half year period. There is no discussion of precipitation levels prior to the readings or longer term readings from other wells in the area. As referenced in Table 2-3, there are recorded readings of up to 2.68 feet above the March 1995 readings. Most of the pre-existing monitoring wells are located at lower elevations, nearer to the discharge streams, and are therefore likely to have a smaller range of water table elevation variability than the piezometers located at higher topographic elevations.***
- ***Padding the 3/11/95 elevations one foot hardly seems adequate to provide a reasonable estimate of the long-term seasonal high water table elevations, considering there are historic readings of the piezometers over five feet higher and historic readings of the monitoring wells (at lower elevations) almost three feet higher. A more accurate estimate of long-term seasonal high water table elevations must be established for each individual piezometer.***

  Since the previous submittal of the Phase III Expansion Construction Permit Application in November 1995, additional ground-water elevation data from Phase III area piezometers have been collected through August of 1996. These additional data have been tabulated and are summarized in Table 2-2. Based on the evaluation of these new data, a new estimate for the long-term seasonal high ground-water table has been developed (Drawing D-2). Section 2.2.2 of the Design Hydrogeologic Report has been modified to include a discussion on how the new long-term seasonal high was developed.

Section 2.4.2: The discussion of Vertical Gradients needs some revision.

- ***The locations of some of the piezometers do not support the statement made in the second sentence of the second paragraph on page 20.***

  The statement made in the second sentence of the second paragraph on page 20 has been amended to more accurately reflect the location of the piezometers.

Section 2.2.2 has been amended to reflect the changes in the estimated long-term seasonal high water table discussion. Vertical separation criteria shown in Table 11-1 have been altered based upon this additional evaluation.

- ***As discussed repeatedly in previous correspondence, the proposed subgrade does not maintain the four foot vertical separation requirement in the vicinity of piezometers B-19 and B-28. The Solid Waste Management Rules and policy require the subgrade to maintain a minimum of four feet of vertical separation from the bedrock as defined in the hydrogeologic subsurface investigation.***

  As shown in Drawing C-2 and which is summarized in Table 11-1 of the report, a minimum of 4 feet is maintained between the bedrock and the base of the liner system at all boring/ piezometer locations.

- ***The notes below Table 11-1 reference Figures 3-3 and 3-7. These references appear to be incorrect.***

  The notes below Table 11-1 have been amended to reflect the proper reference.

- ***The Subgrade Plan (Drawing C-2) needs to show the exact location of all of the piezometers in order to facilitate interpretation of the vertical separation criteria.***

  The proposed subgrade has been added to Drawing D-6, which also shows all existing soil borings, piezometers, and monitoring wells in and near the Phase III area.

Appendix: Boring Logs.

- ***A number of the soil descriptions and/or soil classifications are not consistent with the laboratory soil testing results, as found in Appendix B.***

  The soil descriptions/classifications found on the laboratory soil testing results included in Appendix B have been amended to reflect the proper soil classifications(s). A number of the classifications were found to be in error based on the grain-size distribution data curves developed by the laboratory.

- ***There are virtually no rock descriptions, recovery values, or RQD values reported for the rock cores.***

  Rock descriptions, recovery values, and RQD values for all cored locations (which were erroneously not included in the original submittal) are included on the core description logs contained in Appendix A.

The Plan has been amended to reflect two background monitoring wells. One well is proposed for installation in the gneissic material (MW-15) and one in the granitic material (MW-16).

- ***Generally it would be better to locate a background well further than 90 feet from the waste boundary, as proposed.***

Background monitoring well MW-15 (Gneiss) has been proposed at approximately 225 feet southwest of the waste boundary. Background monitoring well MW-16 (Granite) has been proposed at approximately 275 feet southeast of the waste boundary.

- ***Generally fifteen-foot well screens are used for monitoring wells screened across the water table in order to allow for seasonal fluctuations in the water table.***

All proposed shallow monitoring wells will be constructed with 15-foot well screens, and the deep monitoring well will be constructed with a 10-foot well screen.

Downgradient (Detection) Wells:

- ***Downgradient monitoring should be located between 100 and 150 feet from the waste boundary. The proposed locations for wells MW-18, MW-19, and MW-20 are too far from the waste boundary.***

All proposed downgradient monitoring wells have been placed approximately 125 feet downgradient of the waste boundary.

- ***Drainage features are sometimes areas of geologic weakness and being more highly fractured are possible preferential groundwater flow pathways. The downgradient wells should therefore be located in these drainage features.***

- ***Based upon the preceding two points, proper location of the monitoring wells may make it necessary to relocate and/or redesign some of the sedimentation control basins.***

- ***Should additional wells be considered . . .***
  - ***at the head of the drainage basin on the west side of the landfill cell, about 500 ft. south of MW-21, or***
  - ***in the weathered Diorite near piezometer B-34 that is two orders of magnitude more conductive than the surrounding material?***

Additional detection monitoring wells have been proposed as follows: installation of MW-24 approximately 500 feet south of proposed well MW-23 at the head of the western drainage basin; installation of MW-18 and MW-18D in the weathered diorite near existing piezometer

- ***Hydrostratigraphic Geologic Cross-sections (D-5A & D-5B): The cross-sections do not characterize the vertical ground-water flow regime, as required by .1623(b)(2)(G). No vertical equipotential lines or flow lines are shown. Also, there are discrepancies between the illustrated information and the information in the Boring Logs. Verification is needed to ensure accurate information is shown for ground surface elevations, water table elevations, boring depths, auger refusal depths, etc.***

  Hydrostratigraphic Geologic Cross-Sections (D-5A & D-5B) have been amended to reflect the vertical ground-water flow regime in accordance with .1623(b)(2)(G). All information shown on the sections has been verified and amendments have been made (as needed).

- ***Drawing D-6, Proposed Monitoring Well Locations: Refer to previous comments on the monitoring system.***

Drawing D-6 showing the proposed monitoring well locations has been amended to reflect the changes made to the Water Quality Monitoring Plan.

Respectfully submitted,

HDR Engineering, Inc. of North Carolina

Joseph C. Readling, P.E.
Project Manager

Curtis M. Welty, P.G.
Senior Geologist

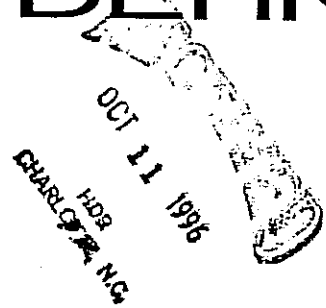
JCR/CMW/nct

6770-021-018

State of North Carolina
Department of Environment,
Health and Natural Resources
Division of Waste Management

James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary
William L. Meyer, Director

DEHNR



October 9, 1996

Elizabeth Treadway
Director of Environmental Services
City of Greensboro
Post Office Box 3136
Greensboro, North Carolina 27402-3136

Re: Permit to Construct Application
Proposed City of Greensboro Municipal Solid Waste Landfill

Ms. Treadway:

The Division of Waste Management, Solid Waste Section (Section) has completed the initial technical review of the above referenced project. The following items must be provided or addressed in order to continue the review process. Revisions to the application must be made in accordance with 15A NCAC 13B .1603(b).

.1620(d)(1)(A) The Engineering Plan, Section 3.1.2 refers to possible revisions to the base grade elevations. The base grade elevations must be finalized prior to issuance of the permit. Additional comments relating to the base grade elevations are contained in the hydrogeological review memorandum.

.1620(d)(2)(A) & (B) The calculations in the report have been reviewed. However, a brief discussion of the analytical methods, conditions evaluated, and assumptions needs to be included in the engineering report.

.1620(d)(4) Please refer to the attached hydrogeological review memorandum.

.1620(e)(1) Revise the existing topography to reflect actual existing conditions at the site to include all grading and the berm(s) that exist within the facility.

.1620(e)(2) The Section recommends adding a requirement that survey verification of the sub-grade be provided to the CQA consultant prior to placement of clay liner. In a similar fashion, survey verification of the clay liner should be provided to the CQA consultant prior to placement of the HDPE line. This is indirectly implied in portions of the Technical Specifications, however, a direct requirement may avoid potential problems.

.1624(b)(5) & (6) Indicate on plans the location of the permanent (or proposed permanent) benchmark locations.

P.O. Box 27687,
Raleigh, North Carolina 27611-7687
Voice 919-733-4996

Reduce Reuse Recycle

FAX 919-715-3605

The Section reserves the right to request additional information as the review warrants. Operations Plans and Closure/Post Closure Plans are currently being reviewed by Section field staff. Additional comments may be forthcoming for these areas.

If you have any questions or if we can provide any assistance, please do not hesitate to contact this office at (919) 733-0692 extension 266.

Sincerely,

Wm D Sessoms

William D. Sessoms, PE

copy: Bobby Lutfy - DWM
Hugh Jernigan - DWM
Eric Wright, PE - HDR

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State of North Carolina
Department of Environment,
Health and Natural Resources
Division of Waste Management

James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary
William L. Meyer, Director

DEHNR

September 3, 1996

MEMORANDUM

TO: Bill Sessoms

FROM: Bobby Lutfy B.L.

RE: Hydrogeologic Review Of The City Of Greensboro Phase III Expansion Construction Permit Application

The preliminary hydrogeologic review of the proposed Phase III expansion to the Greensboro White Street Landfill Construction Permit Application has been done. There are a number of issues that must be addressed before the hydrogeologic permit review can be continued. Please have the City of Greensboro and their consultants respond to the following items:

DESIGN HYDROGEOLOGIC REPORT:

Section 2.2 The estimates of the long-term seasonal high water table elevations are not adequate.

- While the 3/11/95 ground-water elevations appear to be the most reasonable single set of water table measurements representative of seasonal high conditions for the season of record (12/94 thru 10/95), they are not adequate to characterize the long-term seasonal high conditions. There are recorded readings in Table 2-2 at some piezometer locations of up to over five feet above the 3/11/95 levels.
- The estimation of long-term water table elevations (Table 2-3) is based on only four readings spread over a two and a half year period. There is no discussion of precipitation levels prior to the readings or longer term readings from other wells in the area. As referenced in Table 2-3, there are recorded readings of up to 2.68 feet above the March 1995 readings. Most of the pre-existing monitoring wells are located at lower elevations, nearer to the discharge streams, and are therefore likely to have a smaller range of water table elevation variability than the piezometers located at higher topographic elevations.

P.O. Box 27687,
Raleigh, North Carolina 27611-7687
Voice 919-733-4996

NRC Reduce Reuse Recycle

FAX 919-715-3605

- The notes below Table 11-1 reference Figures 3-3 and 3-7. These references appear to be incorrect.
- The Subgrade Plan (Drawing C-2) needs to show the exact location of all of the piezometers in order to facilitate interpretation of the vertical separation criteria.

Appendix A Boring Logs
- A number of the soil descriptions and/or soil classifications are not consistent with the laboratory soil testing results, as found in Appendix B.
- There are virtually no rock descriptions, recovery values, or RQD values reported for the rock cores.

Appendix B Geotechnical Analyses
- There are a number of errors and/or discrepancies between the summary table of Soil Boring Depth And SPT Resistance Data and the information reported in the Boring Logs. No information is reported in the summary table for borings B-36, OW-1, OW-2, or OW-3.
- The depths of the soil samples are not identified on the Grain Size Distribution sheets. Many of the soil descriptions and/or soil classifications differ from those indicated in the Boring Logs.

Appendix C Piezometer / Monitoring Well Construction Sheets
- There are no Piezometer or Well Construction Sheets included in Appendix C.
- In the summary table provided for Observation Well Construction Details, the Riser Stick-up information is missing for a number of the piezometers.
- There are a number of errors and/or discrepancies between the summary table and the information provided in the Boring Logs.

WATER QUALITY MONITORING PLAN:

Background Well:
- A complex geologic setting is described with two major geologic types and yet only one background well is proposed. At a minimum there should be one background well in the Gneiss materials and one in the Granite materials.

- While an accurate Drawing D-2 based upon the March 11, 1995, water table data will fulfill the requirement of rule .1623(a)(9), a separate ground-water contour map based upon the estimated long-term seasonal high water table elevations is needed to fulfill .1623(b)(2)(E).
- Hydrostratigraphic Geologic Cross-sections (D-5A & D-5B): The cross-sections do not characterize the vertical ground-water flow regime, as required by .1623(b)(2)(G). No vertical equipotential lines or flow lines are shown. Also, there are discrepancies between the illustrated information and the information in the Boring Logs. Verification is needed to ensure accurate information is shown for ground surface elevations, water table elevations, boring depths, auger refusal depths, etc.
- Drawing D-6, Proposed Monitoring Well Locations: Refer to previous comments on the monitoring system.

CITY OF GREENSBORO

NORTH CAROLINA

P.O. BOX 3136
GREENSBORO, NC 27402-3136

July 30, 1996

Mr. James C. Coffey
Supervisor - Permitting Section
Division of Solid Waste Management
N.C. Department of Environment,
Health and Natural Resources
401 Oberlin Road, Suite 150
Raleigh, NC 27605

Re: Phase III Construction Permit Application
City of Greensboro Landfill

Dear Mr. Coffey:

Enclosed please find two copies of the Phase III Construction Permit Application text and drawings. This application package was withdrawn to incorporate modifications which have been made in response to comments generated by the Site Study review process. This application is hereby being resubmitted for your review and action.

Summary of Major Revisions:

- The drawings have been modified to exclude the Duke Power substation from the 300 foot property line buffer.
- The volume calculations have been updated based on the revised grading plans.
- Seismic and slope stability calculations have been added to support the previous conclusions of landfill stability. Notes have been placed in the text as requested.
- The Design Hydrogeologic Report and the Water Quality Monitoring Plan have been revised to be consistent with the final presentation provided in the Site Study.

Your attention and assistance in completing the permit process is greatly appreciated.

Sincerely,

City of Greensboro

for Elizabeth Treadway
Director, Environmental Services

Enclosures (2 sets)

CITY OF GREENSBORO

NORTH CAROLINA

P.O. BOX 3136
GREENSBORO, NC 27402-3136

November 27, 1995

Mr. William D. Sessoms, P.E.
Permitting Engineer
Solid Waste Section
Division of Solid Waste Management
DEHNR
401 Oberlin Road, Suite 150
P. O. Box 27687
Raleigh, NC 27611

Dear Mr. Sessoms:

Enclosed are two copies of the second phase application for the permitting of a new Subtitle D landfill cell at the White Street Landfill. This represents the construction application for Phase III. These documents were prepared with the assistance of HDR Engineering Inc. and questions or inquiries should be directed to:

Mr. Dale James	Mr. Joe Readling
Solid Waste Manager	HDR Engineering, Inc.
City of Greensboro	704-338-1800
910-373-2035	

Your attention and assistance is greatly appreciated.

Sincerely,

William H. Carstarphen
City Manager

Enclosure (2): Construction Drawings
Application Documents